Dive Summary 4202 - 26 June 2006 - Port Observer: K. Von Damm

Port: K. Von Damm ***Starboard:*** G. Luther ***Pilot:*** M. Spear

Objectives: Find M; recover Hobos, sample, deploy markers and settling experiments, transit via Q, and Tica to Bio9 vent area.

For reference: Local time = 0800; GMT = 1400; Local = GMT-6

Dive 4202 ended up being the first of this series to get to the seafloor and do science. Due to severe ground fault issues on 4201, while it got to the seafloor, the ~1.5 hours of bottom time was spent trying to fix ground issues at their landing site. When these could not be resolved that dive then returned to the seafloor without achieving any of its objectives. Therefore 4202 basically had the same dive plan as 4201.

As 4202 was essentially the first dive , and the first dive within a newly deployed transponder net, one of the inital goals for this first dive into a changed landscape was to establish our location and tie our navigation to the earlier work at this site. With this objective in mind, out first goal was to find M vent which had been imaged in the New Horizon camera tows and unequivocally identified by the Hobo imaged in that vent that we (KVD) had deployed in March 2004.

The sub departed the surface at ~1411. At ~1417 we turned on the ECHEM system at a depth of 200m. At ~1443 at a depth of 1014m we turned on the magnetometer and started our first spin which was counterclockwise and began at a heading of ~360. We finished our spins at ~1512 at a depth of 1821m.

When we landed on the seafloor the surface position had us at x=4140 y=78897, which would place us about 100m further west than our intended landing site, which was to be 100m west of the axis. At our landing site, ~150-200m west of the ASCT we appeared to be mostly on old (1991) flow with some (estimated) 1 year old flow. There was no clear pattern of which was on top or underneath, just some small tongues of 2006 flow, covering maybe 20% (?) of the surface. While sitting at our landing site at 1538 (0948) we noted grounds on the downlooking (Dan) camera, the high temperature probe, and the basket light. Before leaving our landing site we collected **Rock Sample # 1** (time = 1610, x=4135 y=78897 d=2504 hdg=145). This sample of basalt, of what appeared to be the 2006 flow, was stowed in the port aft milk crate. We attempted to deploy **Marker #1** at this site (time=1617, x=4135 y=78897 d=2504 hdg=145), but the marker launcher did not appear to be working. [N.B. When we got to the surface Marker 1 was no longer in the launcher, so it is not clear if it was indeed deployed at this site, or fell out some time later during this dive.]

We then began to transit east towards the ASCT and M vent. We had the IMAGENIX running as we crossed the axis, over to the top of the east wall. As our landing site was slightly north of the y-coordinate for M vent, once we got to the top of the east wall, we turned to head slightly south. We then arrived quickly at M vent.

Our coordinates at M vent were x=4418 y=78878, compared to the previous values of x=4401 y=78904. We observed three sulfide structures at the M vent site, all lined up along the top of the east wall - all were extinct, the Hobo was in the middle one (ID ing that unequivocally as M vent), and the white cap (alvinellids?) located on the northernmost structure and seen in the New Horizon tow cam photos was no longer present. There were several striking changes at the M vent site. First, the vents were extinct (M vent had been imaged in the 1989 ARGO work so it had pre-dated and survived the 1991 eruption). Second, where M had been on the top of the east wall of the ASCT, there was now collapse behind it, stranding M and the other sulfide structures on more of a remnant, separated by an at least several meter wide channel from the wall, i.e., the top of the ASCT wall had collapsed behind , i.e., to the east of the location of M vent and the other sulfides. On the top of the remnant on which M now stands, 2006 flow had clearly swirled around the base of the sulfide, and there was a rim of new flow standing up, showing where it had flowed up to, and then clearly drained out and collapsed, leaving a several cm thick rind of new flow in an almost vertical position (side of a collapsed lobate perhaps?).

We excavated the M vent structure, partly to retrieve the Hobo and also partly to see if we could get fluid flow started. We observed a small amount of diffusely flowing fluids exiting in one area of the chimney. A crab was crawling around in it which suggested it was very low temperature. As the high T probe was not working, we used one of the majors pairs with an ICL on it to measure the temperature. As it recorded only 2.7°C, barely above ambient, we did not collect a sample. In working around M, we had a volunteer basalt sample (**Rock Sample #2**) land in the front of the mesh basket at time=1711 hdg= 117 depth=2504. We retrieved **Hobo #6** from M vent. We also retrieved the sulfide that the Hobo had been in (**Rock Sample #3** x=4416 y=78879 d=2504 hdg=109) and placed it in the aft stbd milk crate (it was too large to place into the small grey bioboxes that were available and the clear biobox was full of deployment experiments). We then collected a sample of the new basalt that had flowed around the base of M vent (which was a mere oxidized sulfide stump at this point), **Rock Sample #4** (x=4419 y=78878 hdg=16) and placed it in the stbd aft milk crate, the same place as the sulfide from this same site. There was no orifice or flow into which to place a new Hobo. To unequivocally mark this as M vent, we deployed Marker #13 (time=1755 x=4418 y=78878 hdg=17) by using the manipulator (i.e., we did not try to launch it from the marker launcher). It should be noted that the depth when sampling at M was previously 2505m, and was now 2504m, unchanged within the precision of the measurement.

As there was no diffuse flow at M we did not deploy the colonization experiments as there was no appropriate setting for them.

We started the 2nd set of video tapes at 1800.

We departed M vent at ~1803 to transit the ~100m south to Q vent, which also sits atop the east wall.

We quickly found Q vent (x=4420 y=78791 in new nav, x=4408 y=78791previously) and observed 3 sulfide structures coated with white. In the area immediately surrounding Q we also observed some diffuse flow. In at least one of these diffuse flow areas an amphipod swarm was noted. There was one white covered sulfide structure on the wall leading down into the ASCT that we perused looking for the Hobo deployed at this site. There was a second sulfide structure relatively close to this one essentially on the ASCT rim, and then a third (and larger - 8-10m(?)

high) structure further back from the rim. These 3 structures have been observed previously at this site, the one furthest from the rim being sometimes referred to as X5'. All three were at least oozing fluid (partly indicated by the white material covering all of them), if not outright venting black smoke. (We did not go and closely examine all of them.) The Hobo was located in the sulfide located right on the top of the east wall rim, marking it unequivocally as Q vent and we set-up to sample it and retrieve the Hobo from it. As there was a strong current, in order to fluid sample we had to set-up on the side away from the Hobo. The first thing we did was collect the sulfide orifice **Rock Sample #5** which broke into several small pieces (time=1854 x=4426 y=78775 hdg=218 d=2501m stowed in grey biobox #1). We then proceeded to collect water samples. A we had no hi T probe, all of the temperatures were measured with the ICLs on the majors bottles. We fist collected the **Blue Majors Pair** (time=1908 x=4426 y=78776 hdg=206 d=2501). The ICL read a max of about 300°C, but I have a question as to the validity of this measurement as the ICL was reading negative numbers at first. We next collected the **White Majors Pair** (x=4426 y=78775 hdg=216 d=2502). The maximum temperature recorded with either ICL was 318°C. We then collected the Yellow Gas Tight (time=1936 x=4426 y=78775 hdg=220 d=2502), we weren t sure if we heard it fire and the ram was not retracted until the bottle was back in the basket which may compromise its sample quality. We then collected the **Black Gas Tight** (time=1944) which we heard fire and should be a good sample. We finally collected the **Orange Gas Tight** at 1946. We then deployed **Hobo #20** in this orifice (time=1954 x=4426 y=78775 hdg=223 d=2502).

We had tried to use the ECHEM probe earlier in the dive, but there was a problem with the Hg on the electrodes (or lack therefore). We did hold the probe ~0.5-1m above the Q orifice (time =2001) when we finished sampling the water in an attempt to poison the electrodes and therefore regenerate them, but this was unsuccessful and hence the probe was not used for the remainder of the dive.

We then set-up to recover the **Green Hobo**, which took a while as it was cemented into the structure, below the level at which we had been sampling. We were able to retrieve this (old style) Hobo, although not without breaking off the tip. Finally we picked up a basalt sample of the new flow **Rock Sample # 6** (time=2026 x=4429 y=78776) from near the base of Q. We then departed the Q vent area to head south (170) towards Tica, Bio9, etc. Because of the problems with the marker launcher (i.e., it wasn t working) we did not deploy a specific marker here, but the placement of Hobo #20 in the sampled orifice unequivocally marks Q vent. As Q is on the edge of the wall, depths can vary when sampling it depending on how the sub is positioned. Once again the old depths (2504) and new depths (2502) are not significantly different within their attendant errors.

While M was dead, my general impression was that Q was at least as hydrothermally active as before, if not perhaps even more so in terms of the amount of (diffuse) fluid flow.

We were starting to run short of time and power, so we decided to head south in a relatively quick manner. We were in sight of the bottom at all times, but did not stop to investigate particular things/places observed. Hence the next part of my transcript will just indicate where/when places of particular interest (usually more robust diffuse flow marked by

white material) was observed. As to our navigation during this drive south, it should also be noted that we crossed the baseline the surface was using to track us. The surface called down to tell us they thought we were going north when we were actually going south. We had ***NO*** confusion in the sub as to where we actually were. It is the DVLNAV x-y s that appear on the overlays and they incremented as expected. Hence the x-y s mentioned below are the ones from the overlay and are correct.

At ~2050 (x=4519 y=78345) **lots** of white stuff, and some dead Riftia tubes. This is a place worth investigating further.

At, and just prior to 2051, (x=45xx y=78325) we passed through an area of robust fluid flow and lots of white stuff.

At 2059 (x=4561 y=78140) we observed lots of dead ***Riftia*** tubes.

For other areas of interest during the transit south, it would be best to view the frame grabber or watch the video tapes directly. Some of the transit was done in the ASCT, some up on the top of the east wall. It was mostly (if not entirely) 2006 flow that was observed (i.e., lots of new lava including out of the ASCT as they were lobates). Also I repeatedly checked the co-ordinates versus the historical one for places like East Wall, Mussel Bed, etc., and it was my impression that many of the areas of more intense diffuse flow and white stuff were close to these previous areas of fluid flow and animal communities.

It was a high priority for this dive to reach the Bio9 area, if not to sample ourselves, at least to obtain the information needed for subsequent dives. As we came into this area there was decidedly more murk in the water - almost like being in dilute and somewhat greyish milk. Visibility was reduced. As we came into the Hole-to-Hell area my impression was that it was a very confusing place. Our approach was not down the ASCT, and of course there was not the track of Biomarkers starting with number 1 to follow. It would be best to examine the dive track for our exact position. Eventually I realized we were likely too far south and too far to the west so I asked Mark to drive east to the top of the east wall. We did this over what seemed to me a deeper and likely broader ASCT. We were fast running out of time. We got to the top of the east wall and turned to go north. I could see some white structures so I asked Mark to turn west, into the ASCT. One of the large white structures turned out to be a large basalt remnant (~10-15m high, 5-7m across?) covered in white. I knew it was basalt because of both the bathtub rings on it, as well as its general shape and morphology. This was some distance out my port view port. We really had to leave the bottom. As I turned to look aft out my viewport, I noted just in front of the remnant (i.e., just a bit further west) was a large spire covered in white. Based on its morphology I think this was a large sulfide structure likely at least oozing fluids. These observations were made at 2116 (x=4550 y=77909). At the time I noted I thought this might be Bio9, but thinking about the location in the ASCT and near a remnant, and the y-co-ordinate, during the ascent I realized this was most likely P vent.

Weights away at 2117.